W. I. A.—8. Issued October 12, 1916.

United States Department of Agriculture,

BUREAU OF PLANT INDUSTRY,

Western Irrigation Agriculture,

WASHINGTON, D. C.

THE WORK OF THE HUNTLEY RECLAMATION PROJECT EXPERIMENT FARM IN 1915.[1]

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INTRODUCTION.

The work of the Huntley Experiment Farm is devoted chiefly to experiments with crops grown under irrigation. In these experiments are included crop rotation and tillage methods, tests of pasture grasses, tests of cropping methods, variety tests of field crops, and tests of fruit trees, small fruits, and vegetables. In addition to the experiments on the irrigated land, a part of the farm lying above the irrigation canal is used for experiments with dry-land crops. One tract of this dry land, containing about 40 acres, is used for crop rotation and tillage experiments. A map of the land used is shown in figure 1. Experiments in pasturing dry-land crops were started in 1915 on an additional tract of dry land containing about 30 acres. The dry-land work is under the direction of the Office of Dry-Land Agriculture. This report deals only with the experiments relating to irrigated crops and gives the more important features of the work and the results accomplished in 1915.

CONDITIONS ON THE PROJECT.

CLIMATIC CONDITIONS.

In 1915 the rainfall at the Huntley Experiment Farm was somewhat above normal, and a large part of it occurred during the months of May, June, and July. The total for the year was 17.54 inches, while the average for the five years from 1911 to 1915, inclusive, was 14.05 inches. The frost-free period was 120 days, while the average for the past five years was 128 days. The first frost in autumn oc-

[1] The Huntley Experiment Farm is located on the Huntley Reclamation Project, near the town site of Osborn, Mont. It comprises about 270 acres of public land, of which about 40 acres lie above the irrigation canal. In addition, a tract of 40 acres of the heavy land near the town of Worden is used for experiments in reclaiming alkali soils. The work of the farm is under the supervision of the Office of Western Irrigation Agriculture. The Office of Dry-Land Agriculture and other offices in the Bureau of Plant Industry and the Montana agricultural experiment station are cooperating in the investigational work.

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curred on September 19, when the temperature recorded was 32° F. This freezing was not severe enough to injure most crops, and the first frost that seriously damaged crops did not occur until October 3.

A summary of the climatological observations made during the past five years is given in Table I.

TABLE I.—*Summary of climatological observations made at the Huntley Experiment Farm, 1911 to 1915, inclusive.*

PRECIPITATION (INCHES).

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1911	0.64	0.32	0	0.85	3.29	2.13	0.81	1.05	0.57	0.88	0.82	0.13	11.49
1912	.27	.21	.41	2.00	2.44	1.14	2.25	1.39	2.97	3.25	.75	0	17.08
1913	.29	.10	.40	.43	1.27	2.20	1.10	1.19	1.43	2.89	.45	.17	11.92
1914	.11	.19	.52	1.16	2.93	3.31	.05	.76	1.90	1.07	.07	.24	12.21
1915	.41	.02	.78	.23	2.50	5.99	3.11	.50	1.64	.31	1.34	.71	17.54
Average	.34	.17	.42	.93	2.46	2.95	1.46	.98	1.70	1.68	.69	.25	14.05

EVAPORATION (INCHES).

1911				4.388	5.827	7.124	8.875	6.071	5.079	2.568			39.932
1912					4.900	7.020	6.942	6.950	3.722	2.475			32.018
1913					4.300	5.980	7.020	6.300	4.450				28.050
1914				2.770	4.360	4.936	7.778	7.216	4.284				31.320
1915				4.170	4.304	4.582	5.493	6.018	3.348				27.915
Average				3.776	4.733	5.928	7.221	6.513	4.177	2.521			31.847

DAILY WIND VELOCITY (MILES PER HOUR).

Average:												
1911				5.6	5.6	4.5	4.6	4.4	4.4	4.2	5.4	5.5
1912	5.6	5.2	4.8	5.8	6.3	5.2	3.9	3.7	4.2	5.6	4.2	7.8
1913	6.3	5.9	5.2	6.3	4.5	3.8	3.7	3.2	3.6	4.0		
1914			5.3	5.1	4.0	3.2	2.7	3.2	3.5	2.5	3.5	2.5
1915	3.4	2.8	3.7	4.2	5.0	3.9	3.1	2.3	3.4	3.7	3.9	3.6
Maximum:												
1911				9.4	8.8	8.8	8.7	7.2	9.3	10.0	11.6	11.5
1912	12.8	10.8	12.1	13.0	17.5	7.7	6.0	6.5	8.0	14.7	9.7	14.6
1913	11.9	12.6	10.5	10.1	9.2	5.4	8.6	5.7	8.8	8.3		
1914			8.7	10.1	8.5	6.7	5.6	6.4	9.6	5.6	6.4	8.1
1915	7.3	5.8	8.4	10.0	16.2	6.1	6.6	4.5	8.4	9.0	10.6	8.4
Minimum:												
1911				2.0	1.5	2.7	2.3	2.1	1.0	1.3	1.4	1.5
1912	.7	1.6	.9	2.6	1.8	2.3	.6	.8	.9	1.5	1.0	2.7
1913	1.0	1.7	1.9	1.0	.9	1.3	2.1	.8	.4	1.5		
1914			1.6	2.1	1.7	1.6	.3	1.4	1.3	1.1	.8	.6
1915	.3	.8	.8	2.2	1.1	2.1	1.1	.4	1.0	1.2	1.2	1.0

MONTHLY TEMPERATURE (°F.).

Mean:												
1911	14.2	16.1	39.1	43.2	53.8	68.5	67.6	64.1	58.2	44.8	24.9	23.6
1912	16.6	29.1	18.7	46.5	55.5	66.8	67.2	66.6	50.1	44.7	38.7	29.7
1913	14.0	17.7	24.0	46.4	55.0	65.9	68.0	70.0	57.3	41.0	38.2	30.6
1914	27.0	19.0	26.0	45.0	56.0	63.0	75.0	68.0	58.0	48.0	39.0	15.0
1915	19.0	26.0	33.0	54.0	53.0	59.0	65.0	69.0	52.0	48.0	30.0	23.0
Maximum:												
1911	50.0	40.0	74.0	77.0	92.0	94.0	97.0	97.5	94.0	84.5	55.0	55.0
1912	53.0	52.0	62.0	78.0	90.0	99.5	95.0	93.0	89.0	79.0	69.0	59.0
1913	56.0	63.0	61.0	82.0	89.0	98.0	98.0	97.0	94.0	81.0	67.0	55.0
1914	58.0	54.0	68.0	75.0	83.0	93.0	100.0	99.0	89.0	80.0	69.0	48.0
1915	52.0	54.0	66.0	86.0	82.0	87.0	94.0	97.0	89.0	80.0	71.0	42.0
Minimum:												
1911	−26.0	−19.0	− 3.0	17.0	24.0	40.0	41.0	33.5	28.0	14.0	−20.5	−26.0
1912	−35.0	− 5.0	−27.0	20.0	32.0	36.0	44.0	40.0	24.0	17.0	13.0	1.0
1913	−32.0	−21.0	−25.0	20.0	31.0	42.0	43.0	44.0	29.0	20.0	14.0	− 5.0
1914	− 6.0	−38.0	− 3.0	17.0	22.0	36.0	44.0	38.0	33.0	24.0	− 3.0	−23.0
1915	−28.0	− 4.0	11.0	25.0	28.0	36.0	41.0	43.0	32.0	20.0	5.0	−13.0

TABLE I.—*Summary of climatological observations made at the Huntley Experiment Farm, 1911 to 1915, inclusive*—Continued.

KILLING FROSTS.

Year.	Last in spring.		First in autumn.		Frost-free period.
	Date.	Minimum temperature.	Date.	Minimum temperature.	
		° F.		° F.	*Days.*
1911	May 26	32	Sept. 18	28	114
1912	May 13	28	Sept. 16	31	125
1913	May 5	31	Sept. 19	29	136
1914	May 12	32	Oct. 6	31	146
1915	May 21	32	Sept. 19	32	120

CROP CONDITIONS.

The season of 1915 was favorable for the growth of farm crops, although somewhat unusual in the amount and distribution of the rainfall. The winter of 1914–15 was open and mild. April was unusually dry and warm and was followed by cool weather and a heavy rainfall during May, June, and a part of July. The effect of this cool, wet weather was to retard the growth of such crops as potatoes, sugar beets, and corn. Much of the corn was not fully matured at the time of the first frost. The harvest of sugar beets was started about 10 days later than usual, because of the immaturity of the beets. The harvest season for this crop, however, was very favorable. The sugar content of the beets increased rapidly as the harvest advanced, and the average was only slightly lower than in previous seasons, while the tonnage was slightly increased.

TABLE II.—*Acreage, yields, and farm values of crops produced on the Huntley Reclamation Project in 1915.*

Crop.	Area (acres).	Unit of yield.	Yields.			Farm values.			
			Total.	Average.	Maximum.	Per unit of yield.	Total.	Per acre.	
								Average.	Maximum.
Alfalfa	5,287	Ton	15,010	2.82	5	$5.76	$86,458	$16.2	$28.80
Alfalfa seed	2	Bushel	3	1.50	1.5	9.57	29	14.36	14.36
Barley	415	do	8,196	19.75	36	.53	4,344	10.47	19.08
Beans	4	do	49	12.25	20	2.14	105	26.22	42.80
Beets	5,402	Ton	53,911	9.98	17	5.92	319,153	59.08	100.64
Corn	509	Bushel	9,258	18.19	100	.80	7,406	14.55	80.00
Corn fodder	18	Ton	55	3.06	7	3.19	175	9.76	22.33
Hay	440	do	568	1.29	2.5	9.48	5,385	12.23	23.70
Orchard [a]	28	Pound	9,060	323.60	1,000	.025	227	8.09	25.00
Oats	2,514	Bushel	75,319	29.96	119	.49	36,906	14.68	58.31
Pasture	1,478						5,557	3.76	[b]17.00
Peas	4	Bushel	32	8	8	.75	24	6.00	6.00
Potatoes	80	do	9,360	117	400	.72	6,739	84.24	288.00
Rye	11	do	220	20	20	.50	110	10.00	10.00
Spelt	18	do	521	28.94	40	.43	224	12.44	17.20
Truck	234						13,050	55.77	55.77
Wheat	2,869	Bushel	56,863	19.82	50	.87	49,471	17.24	43.50
Less duplicated areas	1,110								
Total	18,203						535,363		
Average								29.41	

[a] Only 10 acres harvested.

[b] Pasture seeded to mixed grasses.

In 1915 the total cropped area on the project was 18,203 acres, as compared with 17,068 acres in 1914. The total irrigable area of the 560 farms in operation was 24,915 acres. Of the cropped area 5,402 acres were devoted to sugar beets, an increase of 1,128 acres over 1914. Alfalfa occupied 5,287 acres, as against 6,107 acres in 1914. Many of the old alfalfa fields were plowed and planted to beets. Most of the remaining area was

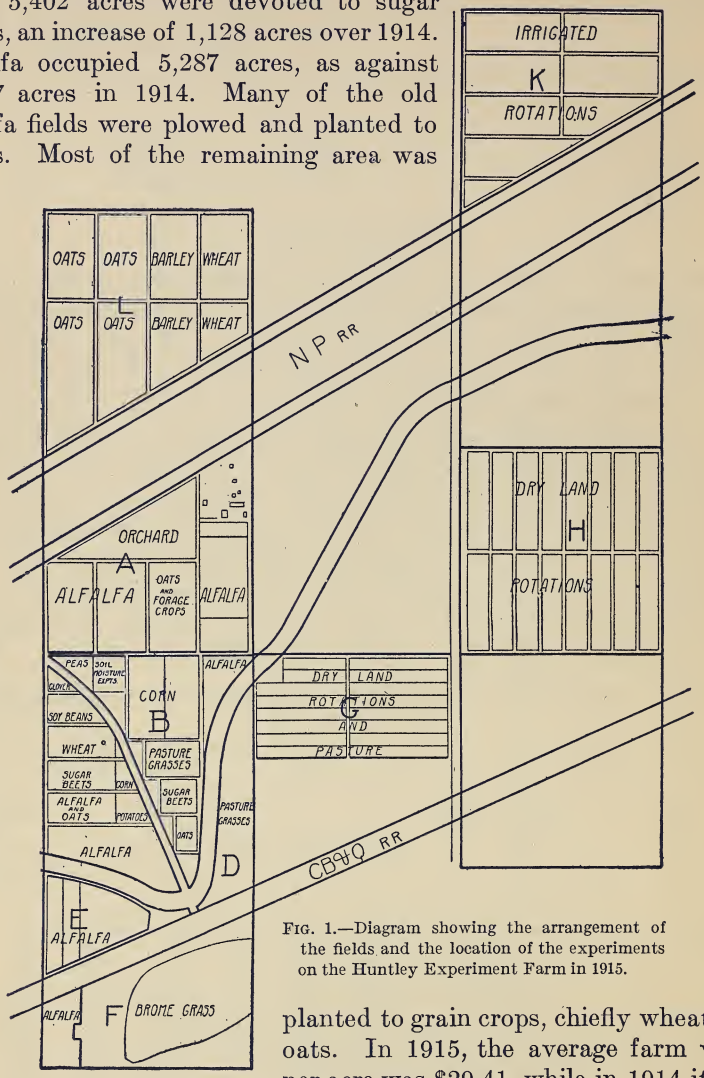

FIG. 1.—Diagram showing the arrangement of the fields and the location of the experiments on the Huntley Experiment Farm in 1915.

planted to grain crops, chiefly wheat and oats. In 1915, the average farm value per acre was $29.41, while in 1914 it was $26.63 and in 1913, $29.35 per acre. The acreage, yields, and farm values of the crops on the project in 1915 are given in Table II. These figures were furnished by the United States Reclamation Service.

LIVE STOCK.

The increase in the number of live stock on the project was less in 1915 than in 1914. The number of cattle increased from 2,921 to 3,316. Of this number, 1,507 were dairy stock. The number of hogs increased from 4,612 to 4,866. The lack of development of this industry was no doubt due to the low prices for hogs that prevailed during 1915. The number of sheep increased from 847 to 6,198. Most of these sheep are kept on the farms during only a short period, being bought for winter feeding. The number of live stock and their value are given in Table III. These figures were obtained from the United States Reclamation Service.

TABLE III.—*Live stock on the Huntley Reclamation Project in 1915.*

Item.	Inventory, Jan. 1.			Inventory, Dec. 31.			Increased total value.
	Number.	Value.	Total value.	Number.	Value.	Total value.	
Horses	2,008	$108.88	$218,640	1,961	$117.37	$230,175	$11,535
Mules	53	134.90	7,150	53	135.09	7,160	10
Cattle	2,921	47.45	138,625	3,316	47.05	156,023	17,398
Sheep	847	3.22	2,730	6,198	4.71	29,199	26,469
Hogs	4,612	9.68	44,536	4,866	5.51	26,822	−17,714
Fowls	23,345	.49	11,356	18,758	.50	9,379	− 1,977
Bees, hives	247	3.07	758	288	5.09	1,467	709
Total			423,795			460,225	36,430

EXPERIMENTS WITH IRRIGATED FIELD CROPS.

The agriculture of the Huntley project and of the irrigated sections in the adjacent territory is rapidly developing a diversity in which the growing of sugar beets and the production of live stock and live-stock products are the major industries. It is the principal purpose of the Huntley Experiment Farm to investigate problems associated particularly with the establishment of these major industries. The successful production of sugar beets requires the establishment of proper crop rotations and cultural practices, the efficient use of barnyard manure, and the control of diseases and pests affecting sugar beets. The establishment of live-stock industries, particularly on the Huntley project, where the farm unit is only 40 acres, requires efficient use of the land in the production of feed crops. Such use depends upon the establishment of satisfactory crop rotations, the improvement of cultural practices, the use of high-yielding field-crop varieties, and in many instances the utilization of irrigated pastures.

Since the establishment of the Huntley Experiment Farm an increasing amount of attention each year has been given to these problems. A summary of the more important developments in the experiments with the various irrigated crops in 1915 is given in this report.

CROP ROTATIONS.[1]

The experimental work with crop rotations was begun in the spring of 1912. Field K (fig. 1), containing 70 quarter-acre plats, is used for this work. The crops included in these rotations are alfalfa, sugar beets, potatoes, oats, wheat, corn, and flax. Three 6-year, three 4-year, three 3-year, and eleven 2-year rotations are used to determine the value of the various crop sequences. Nine of the plats are devoted to the continuous production of the above-named crops on the same land each year, so that a comparison can be made between the effect of continuous cropping and of crop rotation. Standard varieties of those crops which are adapted to this region are used throughout the experiment. A view of field K, where these experiments are conducted, is shown in figure 2.

FIG. 2.—Field K, Huntley Experiment Farm, where the irrigated crop-rotation experiments are conducted. Each plat contains a quarter acre.

The average, maximum, and minimum yields obtained in 1913, 1914, and 1915, are given in Table IV.

Table IV shows a wide difference between the largest and smallest yields obtained from the different plats. In most cases the highest yield was more than twice as much as the lowest. With the exception of the alfalfa each crop was planted on the various plats at the same time, the same variety of seed was used on all plats, and the cultural treatment was the same, so that the difference in yield must be due to the differences in the plats. This difference between the plats on which the same crop is planted may be due in part to soil variation and in part to the effect of the preceding crop, or in certain cases to manuring. It is impossible to give an exact statement of the soil variation. During the first years of the experiment this is doubtless

[1] These experiments were under the immediate supervision of Mr. Edward G. Noble, assistant, who prepared the report here made.

an important factor, but as time goes on it will be possible to analyze the results in such a way as to reduce this factor to very small proportions.

The purpose of this rotation experiment is to determine quantitatively which of the crop sequences is the most favorable for the production of any given crop and what is the value of manuring. It is generally believed that a rotation of crops and the use of farm manure are beneficial, but there is very little definite knowledge as to just how beneficial they are, or, in other words, whether either crop rotation or manuring is really worth while on these new irrigated lands. It is believed that this rotation experiment may give some definite information on these points.

TABLE IV.—*Average, maximum, and minimum yields obtained in irrigated rotation experiments on the Huntley Experiment Farm in 1913, 1914, and 1915.*

Crop.	Variety.	Number of plats.	Unit of yield.	Yield per acre.								
				Average.			Maximum.			Minimum.		
				1913	1914	1915	1913	1914	1915	1913	1914	1915
Alfalfa:												
Second, third, and fourth year.	Montana	9	Ton	5.46	5.41	6.84	6.29	6.26	7.92	4.21	4.46	[a]4.72
First year	do	6	do	2.20	2.22	2.34	2.51	2.59	2.64	1.79	1.47	1.89
Sugar beets	Kleinwanzlebener.	14	do	13.08	11.16	9.58	16.80	15.09	15.45	9.25	6.67	4.84
Potatoes	Rural New Yorker.[b]	13	Bushel	212.7	167.8	301.8	362.0	293.3	420.0	36.0	5.5	189.8
Oats	Swedish Select.	15	do	84.2	89.8	79.3	126.8	115.0	103.7	37.8	45.7	43.1
Wheat	Pringle Champlain.[c]	3	do	27.2	32.7	32.3	36.1	40.7	47.0	17.4	22.9	19.2
Corn	Northwestern Dent.	4	do	42.0	42.9	36.9	48.7	55.1	41.3	33.9	31.6	31.6
Flax	Minnesota No. 25.	2	do	21.7	18.6	21.3	31.3	24.3	28.1	12.1	13.0	14.5

[a] Fourth-year alfalfa.
[b] Variety changed to Mills Prize for the year 1915.
[c] Locally known as Pringle Champion.

With the season of 1915, the experiment completes its fourth year. It is still too soon to draw any definite conclusions from it. The soil variation still remains an important factor and two of the rotations have not yet completed their first cycle, but it is possible to see in the results secured in 1915 some indications which may be useful to those engaged in crop production under conditions similar to those where this experiment is conducted.

Table V gives the yields of oats, potatoes, and beets in 1915 and the preceding crops in each case. The yields of each crop are arranged in order, from the highest to the lowest. An inspection of this table will show which of the preceding treatments gave the best results in 1915. It should be kept in mind that all of the plats are probably not on equally good soil and that these are the results of but one season.

TABLE V.—*Yields of oats, potatoes, and beets, with statement of preceding crops in the rotations, on the Huntley Experiment Farm, 1915.*

[MB indicates manure applied to the beet crop; OR indicates oats followed by rye, to be plowed under the following spring; OM indicates oats with manure applied to the stubble and plowed under for the following crop.]

Oats.			Potatoes.			Beets.		
Preceding crops.	Rotation No.	Yield.	Preceding crops.	Rotation No.	Yield.	Preceding crops.	Rotation No.	Yield.
		Bushels.			*Bushels.*			*Tons.*
Oats Beets Potatoes	30	103.7	Alfalfa Do Do	61	420.0	Alfalfa Do Potatoes	40	15.45
Oats MB Potatoes	31	102.9	Do Do Do	60	396.8	Alfalfa Corn Flax	67	14.62
MB Oats MB	23	96.2	MB Potatoes MB	21	386.5	Alfalfa Potatoes Oats	60	12.90
Oats Beets Corn	32	85.5	OM Potatoes OM	25	373.9	Potatoes MB Potatoes	21	12.79
Potatoes OR Potatoes	27	83.7	Beets Potatoes Beets	20	350.0	OM Beets OM	23	10.69
Alfalfa Do Potatoes	60	81.8	Do Alfalfa Do	40	349.6	Beets Do Do	2	9.98
Potatoes Oats Potatoes	24	81.5	Potatoes Oats MB	31	273.5	Do Potatoes OM	31	9.13
Beets Oats Beets	22	79.2	Oats Potatoes Oats	24	273.4	Alfalfa Potatoes OM	61	87.3
Potatoes OM Potatoes	25	78.8	Corn Potatoes Corn	26	251.0	Potatoes Beets Potatoes	20	8.33
Alfalfa Do Potatoes	44	78.7	Potatoes Do Do	4	232.0	Alfalfa Do Oats	42	7.65
Alfalfa Do Potatoes	61	75.8	Potatoes Oats Beets	30	227.6	Do Beets Oats	22	6.80
Corn Oats Corn	16	75.5	OR Potatoes OR	27	199.4	Beets Corn Oats	32	6.34
Beets Alfalfa Do	42	73.3	Oats Alfalfa Do	44	189.8	Wheat Beets Wheat	18	5.94
Wheat Oats Wheat	28	50.5				Beets Potatoes Oats	30	4.84
Oats Do Do	1	43.1						
Average of all plats		79.3			301.8			9.58

The season of 1915 was very favorable for the production of alfalfa. Six spring-seeded plats produced an average yield of 2.34 tons per acre. Six second-year plats averaged 7.13 tons per acre, and on two third-year plats an average of 7 tons per acre was obtained.

The average yield of sugar beets in 1915 was 1.58 tons per acre below the average for 1914. Very poor yields were obtained with beets following oats in a rotation without manure. Beets grown on manured oat stubble averaged 9.51 tons per acre, while the average yield per acre of beets after oats without manure was 7.70 tons. The maximum yield of sugar beets was obtained on land which produced potatoes the preceding year. Beets grown for the fourth successive year on the same plat yielded 9.97 tons per acre, or slightly above the average for all plats.

The large increase in the potato yields in 1915 was undoubtedly due in part to the fact that the variety used was better adapted to local conditions than the one grown in previous years. The highest yield was obtained in 1915 on land cropped to alfalfa for three years. Potatoes continuously cropped for four years yielded 232 bushels per acre, while the average for all potato plats was 301.8 bushels per acre.

Oat yields in 1915 were very materially affected by lodging and a subsequent attack of rust. All plats which indicated a heavy yield early in the season were lodged and badly rusted at the time of harvesting. Oats following a cultivated crop averaged 85.2 bushels per acre, as compared to 55.6 bushels when following alfalfa or a grain crop. On ground seeded to oats continuously for four years, a yield of 43.1 bushels per acre was obtained.

The maximum yield of wheat was secured in a 2-year rotation with sugar beets. The lowest yield was obtained from a plat which produced oats the preceding year.

The average yield of corn in 1915 was 36.94 bushels per acre, as compared to 41.97 bushels per acre for 1914. Corn in a 2-year rotation with potatoes produced the maximum yield, 41.29 bushels per acre. The minimum yield was obtained on a plat that has been continuously cropped to corn for four seasons.

Flax grown on ground on which the third crop of alfalfa was pastured in 1913 and the corn crop harvested by hogs in 1914 yielded 28.1 bushels per acre in 1915. A plat continuously cropped to flax for four years produced but 14.5 bushels per acre; yet this yield was the best obtained from this plat during the four years which the experiment has run.

Pasturing alfalfa with hogs.—Rotation 67 consists of corn, flax, beets, and three years of alfalfa. The third-year alfalfa and the corn are harvested by hogs, the object of this experiment being to ascertain the value of alfalfa and corn crops when so harvested.

The alfalfa-pasturing experiment is divided into two periods: April to July, or the spring period, and July to September, or the summer period. The plat used is divided into two equal portions and the hogs are pastured alternately for 10 days at a time on each

part. This allows for more uniform growth and convenience in irrigating. In addition to the pasture, the hogs are given a supplementary ration of 2 pounds of corn per day per 100 pounds live weight.

On April 24 five high-grade Duroc-Jersey hogs weighing 789 pounds were placed on the alfalfa plat. On May 24 it was found necessary to remove one hog, as the supply of feed was inadequate. The remaining four hogs were taken off July 14, and on the same date eight pure-bred Duroc-Jersey shoats, shown in figure 3, were placed on the plat. These shoats, having a total initial weight of 302 pounds, remained on the pasture until September 22.

During the two periods 619 pounds of pork were produced. The corn consumed during the season amounted to 1,949 pounds. Esti-

FIG. 3.—Hogs in an alfalfa pasture in rotation 67, Huntley Experiment Farm. In 1915 a return of $75.88 per acre was secured by pasturing this plat with hogs and feeding a 2 per cent ration of corn as a supplement.

mating the value of the pork at 7 cents per pound gives a total return from the plat of $43.33. The value of the corn fed, estimated as worth $1.25 per 100 pounds, was $24.36. This leaves a net return from the alfalfa crop of $18.97 for the plat, which is at the rate of $75.88 per acre, as compared with a net return of $76.88 from a similar experiment conducted in 1914.

The average yield of third-year alfalfa in other rotations was 7 tons per acre. Assuming that this plat would have produced 7 tons of hay per acre, the return of $75.88 is equivalent to $10.84 per ton for the hay crop which was consumed by hogs.

These results and also those secured in 1913 and 1914 indicate that the possibilities of pasturing alfalfa with hogs should receive careful consideration by the farmers on the Huntley project.

Where potatoes follow alfalfa the yield has been increased by 125 bushels per acre and the proportion of marketable tubers by 21 per cent.

TABLE VII.—*Crop yields per acre and crops of preceding years in the rotation experiments at the Scottsbluff Experiment Farm in 1915.*

[Oats-M indicates manure at the rate of 12 tons per acre applied to the oat stubble and plowed under for the following crop; potatoes-M indicates manure applied at the same rate after the potatoes were harvested; oats-R indicates that rye was seeded in the oat stubble to be plowed under as green manure the following spring.]

Rotation No.	Beets. Crops in preceding years.	Yield.	Rotation No.	Potatoes. Crops in preceding years.	Yield.
		Tons.			*Bushels.*
42	Alfalfa, alfalfa, oats	16.35	60	Alfalfa, alfalfa, alfalfa	231.5
40	Alfalfa, alfalfa, potatoes	16.32	44	.....do	227.7
23	Oats-M, beets, oats-M	15.92	61	.....do	220.2
31	M-beets, potatoes, oats-M	15.56	40	Beets, alfalfa, alfalfa	205.6
61	Alfalfa, potatoes, oats-M	15.32	31	Potatoes, oats-M, beets	175.0
62	Alfalfa, corn, oats	13.32	25	Oats-M, potatoes, oats-M	147.6
21	Potatoes-M, beets, potatoes-M	13.13	21	Beets, potatoes-M, beets	147.2
60	Alfalfa, potatoes, oats	12.48	30	Potatoes, oats, beets	145.8
18	Wheat, beets, wheat	12.23	27	Oats-R, potatoes, oats-R	126.9
22	Oats, beets, oats	12.00	24	Oats, potatoes, oats	109.1
20	Potatoes, beets, potatoes	10.58	26	Corn, potatoes, corn	100.7
30	Beets, potatoes, oats	10.20	20	Beets, potatoes, beets	87.6
32	Beets, corn, oats	10.14	4	Potatoes, potatoes, potatoes	65.1
2	Beets, beets, beets	8.23			

Another fact of importance demonstrated in the rotation experiments is the possibility of seeding alfalfa in the fall after a crop of small grain has been removed. Heretofore it has been thought necessary either to sow alfalfa with the small grain as a nurse crop or to postpone seeding until the following spring. There has been some prejudice against sowing alfalfa with a nurse crop, because of the consequent uncertainty of securing a good stand of alfalfa, and if the alfalfa is sown the following spring the crop obtained the first year is small. The practice of seeding in the stubble after the small grain has so far resulted in good stands and in giving nearly a full crop the following year, as is shown in Table VIII, which gives the maximum, mean, and minimum yields for 1915 from the 1915 spring seeded, the 1914 late summer seeded, and the old alfalfa, showing also the 3-year average yield from these different seedings. There is a marked difference in the average yields produced from the spring and fall seedings the first season, the fall seeding yielding nearly as much as the fully established crops.

TABLE VIII.—*Yields of alfalfa in 1915 from 1915 spring seeded, 1914 fall seeded, and old alfalfa, also a 3-year average of the same class, at the Scottsbluff Experiment Farm.*

Number of plats.	Class.	Yield per acre (tons). Maximum.	Mean.	Minimum.	3-year average.
5	1915, spring seeded	1.76	1.60	1.43	1.95
3	1914, fall seeded	4.38	3.92	3.39	4.60
12	Second and third year crops	5.11	4.57	3.88	5.63

THE USE OF HOGS IN DISPOSING OF CROPS.

Since the beginning of the rotation experiments just described, two plats have been harvested by hogs. One of these plats has been in alfalfa and the other in corn. The hogs were kept in the alfalfa plat from early spring until September, being fed a supplementary ration of corn. In September they were turned into the corn plat to harvest the crop.

As fall-farrowed pigs are ready for market about the middle of July when fed a liberal ration of grain and as spring-farrowed pigs are not large enough to begin pasturing in the early spring, it has been necessary to use two lots of hogs during the pasturing season. The first lot was composed of hogs farrowed the previous autumn. During the past season these were kept on the pasture from April 26 to June 25. The second lot was composed of hogs farrowed in the spring. These young pigs were placed on the pasture on June 30. A few of them were removed about the first of September, to prevent overpasturing the plat, and the remainder were kept on the alfalfa until September 27. During the entire pasturing period the hogs were fed a supplementary ration of corn at the rate of 2 pounds of corn for each 100 pounds of live weight. They received, in addition, certain condiments, such as salt, coal, and phosphate rock.

The results of both lots, including the total for 1915 and the average for the three seasons of the alfalfa pasturing, computed to an acre basis, are given in Table IX.

TABLE IX.—*Results per acre secured by pasturing hogs on alfalfa with a 2 per cent corn ration for 1915, compared with the average results for 1913, 1914, and 1915, at the Scottsbluff Experiment Farm.*

Items of comparison.	Season of 1915.			3-year average.
	Lot 1.	Lot 2.	Both lots.	
Initial number of hogs	20	48	.....	.....
Total initial weight.....pounds..	2,160	1,588	.....	.....
Total gains made.....do....	1,244	1,732	2,976	3,321
Corn fed.....bushels..	64.9	60.9	125.8	146.3
Net returns for pasture	$48.14	$84.70	$132.84	$134.69
Corn fed per pound of gain.....pounds..	2.76	2	2.53	2.47
Cost per 100 pounds of gain (pasture at $15; corn at 60 cents)....	$3.70	$2.57	$3.04	$3.10

If values of 7 cents a pound are assigned to the gains made and 60 cents a bushel to the corn consumed, the net return from the first lot is $48.14 and from the second lot, $84.70, or $132.84 for the season of 1915. On the same basis the average net return for three years is $134.69 per acre. If the first lot is charged $7 per acre for alfalfa pasture and the second lot $8, in addition to a charge of 60 cents per bushel for the corn consumed, the highest cost of feed to produce 100 pounds gain is $3.70. Alfalfa plats similar to the pastured plat

were cut for hay and yielded at the rate of 2.06 tons per acre during the first pasturing period and 2.41 tons during the second period. On the basis of this yield the hogs paid the equivalent of $29.54 a ton for the 1915 alfalfa hay crop. The average yield of hay from similar plats during the past three years has been 5.52 tons per acre. At this rate the hogs have paid the equivalent of $24.40 a ton for hay.

As stated before, the corn plats were very severely damaged by hail, so much so that the results from the hogged plat are almost meaningless. The gain made by the hogs from this quarter acre was only 53 pounds, as compared with 263 pounds in 1914, 252 pounds in 1913, and 157 pounds in 1912. The corn plat hogged in 1912 was on oat land, but since then the corn plat has followed alfalfa. The yield of the corn on the hogged plat was carefully estimated each year. If these estimates are correct, the plats yielded, when computed to the basis of 1 acre, 56.1 bushels in 1912, 82.6 bushels in 1913, and 81.9 bushels in 1914. On this basis, if a value of 7 cents is assigned to the gains made, then the return per acre equals $42.96 for 1912, $70.48 for 1913, and $73.36 for 1914, or a return per bushel of 77, 86, and 90 cents, respectively, for the corn crop.

GRAIN VARIETY TESTS.

SMALL GRAINS.

The variety tests of small grain in 1915 included spring wheat, barley, and oats. In previous years the variety test also included winter wheat, rye, and emmer. These latter crops have not been important enough in the local agriculture to justify further trials.

The hailstorm of August 6 caused serious damage to the grain in the variety tests, so that the results for 1915 are less significant than they might have been under normal conditions. Some of the varieties of oats had been harvested before the storm and the grain in the shock was injured less than the standing grain. Furthermore, the hail injury was less severe on one end of the series than on the other, so that all varieties did not suffer alike. Notwithstanding these conditions it seems desirable to publish the results of the tests, together with a summary of the tests of previous years, in order to keep the record complete.

SPRING WHEAT.

The wheat varieties were sown in duplicate plats of one-twentieth of an acre each in field G, Series III. This series had been in alfalfa three years, from 1911 to 1913, and in sugar beets in 1914. In addition to the six varieties used in 1914, one new variety of bread wheat, the Marquis, was added in 1915, and four varieties of durum wheat were also included.

The yields of these varieties, the average of two plats, for 1915 are given in Table X, together with the five-year average for the varieties that have been grown that long.

TABLE X.— *Yields of spring-wheat varieties at the Scottsbluff Experiment Farm, 1911 to 1915, inclusive.*

Variety.	Yield per acre.			
	1915		5-year average.	
	Grain.	Straw.	Grain.	Straw.
	Bushels.	*Pounds.*	*Bushels.*	*Pounds.*
Ghirka	30.2	5,193	38.8	3,914
Defiance	30.9	6,026	32.9	3,928
Lambahara	30.7	7,364	38.6	4,177
Galgalos	28.6	5,734	37.8	4,009
Rysting	41.6	4,817	33.9	3,639
Dicklow	32.7	6,474	34.1	[1] 5,167
Marquis	32.8	7,170	[2]	[2]
Ble Dur	41.5	6,553	[2]	[2]
Kubanka	43.5	8,083	[2]	[2]
Arnautka	44.0	8,847	[2]	[2]
Beloturka	51.1	7,231	[2]	[2]

[1] Grown in 1914 and 1915. [2] Grown in 1915 only.

The Dicklow wheat was the only variety that was badly affected with rust and had begun to break down badly at the time the hail struck it. This was the second season for the Dicklow wheat, and the indications are that on account of rust and weak straw it is not a desirable variety for this section.

BARLEY.

The barley varieties were grown in field C, Series III, on land that had been in alfalfa three years, from 1911 to 1913, and in sugar beets in 1914. Thirteen varieties were tested, of which eleven were on duplicate plats. The hull-less varieties which had been tested in previous years had been discarded because of low yield, and for the same reason the six-rowed Hooded was not retained. The Thomas variety was eliminated on account of weak straw.

The barley yields for 1915 were unusually high. The variety plats were harvested before the hailstorm of August 6, so that there was relatively little loss on this account. There has been some local prejudice against 2-rowed barley, owing to the belief that varieties of this class are less productive than the 6-rowed varieties. This test shows that there are high-yielding varieties in both classes.

The chief use of barley on the project is for feeding purposes, in which it comes into competition with corn. So far as is known, the two grains are of nearly equal value pound for pound; but on account of the difference in weight per bushel the yields per acre should be reduced to pounds in order to make comparisons. When the yield of barley is 100 bushels per acre, it requires a crop of 86 bushels of

The pasture period extended from April 28 to October 8. During this time the two grade Jersey cows shown in figure 5 were used. They were kept off pasture during stormy weather for an aggregate of 14 days, so that they were actually on the pasture 150 days. On the days that they were off pasture each cow was fed 25 pounds of alfalfa hay a day. The pasture furnished ample feed for the cows until September 1. From that date to the end of the pasturing period each cow was fed 15 pounds of alfalfa hay a day in addition to the pasture.

One of the cows freshened in October, 1914, so she was milking at the beginning of the test. She became dry by September 15 and calved again on October 15. The other cow freshened on June 25, so she was dry during the first part of the test. The cow that was giving milk at the beginning of the test was given a supplemental

FIG. 5.—One of the irrigated pastures used in 1915, Huntley Experiment Farm. Two cows were pastured on three-quarters of an acre of mixed grasses and clover for 150 days.

feed of 6 pounds of chopped corn a day from the beginning of the pasture period to June 15, and the other cow received no grain until July 1. From July 1 to October 14, during the first half of each month, each cow was fed daily 6 pounds of a grain mixture consisting of equal parts of chopped corn, wheat, and oats. No grain was fed during the second half of each month. The increase in milk flow during the period when grain was fed was in no case sufficient to pay for the grain.

The cows produced during the season of 164 days a total of 5,247 pounds of whole milk and 213.7 pounds of butter fat. At the local market prices, the value of the butter fat produced was $52.07. During the entire period a total of 882 pounds of grain and 1,630 pounds of hay was fed. If the hay be valued at $6 a ton and the grain at $1.25 per hundredweight, the total cost of the supplemental

feed was $15.92. This amount, deducted from $52.07, the value of the butter fat, leaves a return of $36.15 for the pasturage produced on three-fourths of an acre. This is at the rate of $48.20 per acre.

The carrying capacity of these three quarter-acre plats in 1914 was the same as in 1915. Two cows were carried through the pasturage season each year on the three-fourths of an acre. This is at the rate of eight cows on 3 acres. The results in 1915 indicate that the pastures are improving with age. These facts, as well as the return of $48.20 per acre secured in 1915, show clearly that irrigated pastures can be made successful on the Huntley project.

There is need for information as to methods of securing some return from these irrigated pastures during the first year, when ordinarily the pastures are not used. A preliminary test of light pasturing was made during the latter part of the season of 1915. One of the quarter-acre plats in field B–V that was planted without a nurse crop in the spring of 1915 to the pasture mixture described on page 13 was pastured during the latter part of the season. On August 27, 1915, a yearling heifer was placed on the quarter-acre plat, where she remained until October 30 except during eight stormy days, when she was kept up and fed alfalfa hay at the rate of 20 pounds a day. While she was on pasture no hay or grain was fed. The quarter-acre plat furnished abundant feed for a total of 58 days. The weight of the heifer at the beginning of the test was 616 pounds and at the close 730 pounds, the gain being 114 pounds. If this be valued at 5 cents a pound, the gain made was worth $5.70 from the quarter acre, or at the rate of $22.80 per acre for the first year's pasture.

At the time the test was started, the grasses averaged 10 to 12 inches in height and had formed a heavy sod. While the growth of the grasses was very light during October, the heavy growth at the beginning of the test was sufficient to furnish grazing during the entire period. The carrying capacity, which was at the rate of four yearling heifers per acre, was certainly satisfactory.

The season appeared to be unusually favorable for starting grasses, and the growth made was exceptionally good. It is doubtful whether such good returns could be expected as a rule during the first year. What the effect of the early grazing will be can not be finally determined until next season, but at the close of the pasturing period in October, 1915, no bad effects were apparent.

SUGAR BEETS.

Root-louse control.—The damage caused by invasions of the sugar-beet root louse is often serious and may result in greatly decreased yields in fields that are badly infested. The root louse lives over winter on the ordinary narrow-leaf cottonwood trees. Migration to

the beet fields occurs during the latter part of June and early in July. In some cases the root louse may live over winter in old beet fields, but it appears that the cottonwood is the main source of infestation. The root lice enter the soil around the beets and deposit their young around the beet roots. A dry soil appears to be a favorable condition for the lice to become established. In ordinary practice sugar beets are not irrigated until the latter part of July, so that the surface of the soil is usually dry during the period when the root lice are migrating. The experiment started in 1914 to determine means of controlling this pest was continued during 1915. This work is done in cooperation with the biology department of the Montana Agricultural Experiment Station. In these experiments three methods were tried, as follows: (1) The land was kept thoroughly irrigated and cultivated at all times during the growing season and especially during the migration period of the root louse; (2) the land was not irrigated until the beets began to wilt from drought; (3) the beets were given the usual treatment as to irrigation and cultivation. These three methods were tried in triplicate on tenth-acre plats.

Because of the unusually heavy rainfall during June and July, the soil on all the plats was thoroughly moist most of the time during the migration period of the root lice. The result of this was that the amount of injurious infestation on any of the plats was comparatively small. What difference there was appeared to favor the plats that had but one irrigation during the season, although this difference was very slight. The highest average yield, which was 13.91 tons per acre, was secured from the plats that received the ordinary treatment, or two irrigations, and the lowest yield, 11.45 tons, was from plats that received four irrigations. The average yield from the three plats that were irrigated but once was 12.18 tons per acre. The plats that received four irrigations in addition to the large amount of rainfall no doubt had an excessive amount of moisture, which very likely resulted in comparatively low yields.

Three of the plats in this test were on land that was in oats and the remaining six plats on land that was in beets in 1914. There was a very marked difference in the amount of infestation between the beets following oats and those after beets. Where the beets followed oats, the percentage of beets infested in any degree was 70.3 and the percentage of beets that were considered to be injuriously infested was 4.70; while where beets followed beets, only 28.9 per cent of the beets were infested in any degree and only 0.73 per cent were injuriously infested. These observations support the theory that the root louse usually does not live over winter in old beet fields.

Considering the results secured in this experiment in 1914 and 1915, it appears that any control measures by irrigation will be effective only in years when the precipitation is not above normal. In 1914 the amount of infestation was controlled to a large degree and the yields of the beets were increased by comparatively frequent irrigation.

Siloing test.—A test to determine the loss in weight and the changes in the amount of sugar in beets when siloed at harvest time was conducted with two lots of beets of about 12 tons each. The siloing was done by placing the beets in piles about 12 feet wide at the base and 6 feet high, which were covered with soil except at the ridge, which was covered with beet leaves.

Samples of the beets for dirt-tare determinations and for sugar analysis were taken, both when the beets were siloed and when they were taken out.

Data relating to the test are given in Table VIII.

TABLE VIII.—*Change in weight and in sugar content of siloed beets on the Huntley Experiment Farm in 1915.*

Silo No.	Number of days in silo.	Weight (pounds).		Loss in weight (per cent).	Average sugar content (per cent).			
		Initial.	Final.		When placed in silo.		When taken out of silo.	
					Number of samples.	Sugar.	Number of samples.	Sugar.
1	41	24,682	24,058	2.5	7	17.4	12	16.3
2	59	24,864	24,216	2.6	20	16.7	10	16.2

The loss in weight in both cases was practically the same. The loss in the amount of sugar in one pile was 1.1 per cent, while in the other it was only 0.5 per cent. The average price received for sugar beets on the Huntley project during the past three years was $6 per ton. On this basis the loss in value of the beets in silo No. 1 for shrinkage was 15 cents per ton and for sugar decrease 25 cents per ton, a total of 40 cents per ton. On pile No. 2 the decrease in value through the loss in weight and in sugar content was 27½ cents per ton. The average loss in value on the two silos was 33.7 cents per ton. Siloed beets have usually been paid for at the additional rate of 75 cents per ton, so that in this case, after allowing for the loss in weight and in sugar content, 41.3 cents would be received for the work of siloing. These figures, however, can not be regarded as entirely conclusive, because of the possibility of error in obtaining the dirt tare on the beets both when siloed and when delivered and also in obtaining the sugar content, because of the small number of samples analyzed; and further work along this line will be necessary

before definite conclusions can be reached. In all cases dirt-tare determinations were made on the samples that were later used for making sugar analyses. In pile No. 1 the average dirt tare on the seven samples that were taken when the beets were placed in the silo was 17.3 per cent, ranging from 7 to 28 per cent. The average tare on these beets when taken out of the silo was 7.7 per cent on 12 samples and the range was from 1.3 to 17.8 per cent. In pile No. 2 the average tare on 20 samples when the beets were siloed was 11.5 per cent, while on 10 samples when they were taken out it was 7.3 per cent, with a range of 4.3 to 24.7 per cent in the former case and of 4.2 to 15.2 per cent in the latter.

FERTILIZER TEST.

During the past three years a fertilizer test in which acid phosphate was applied to the land at three different rates has been conducted in field B–VII on 12 twentieth-acre plats. In 1913 the land was planted to wheat, oats, and barley, but in 1914 and 1915 it was all planted to oats, and the test was made in triplicate. The fertilizer was applied each year to the same plats at the respective rates of 300, 500, and 700 pounds per acre. One set of plats was used in which no fertilizer was applied.

The average yield of oats from all of the plats in 1915 was at the rate of 73.6 bushels per acre. There was but a slight variation from this yield in any of the plats, although the plats without fertilizer yielded somewhat more than any of the fertilized plats. This difference in yield was not great enough to be significant. These results are similar to those obtained in the same test in 1913 and 1914. In no case during these three years has the fertilizer produced any markedly significant effect on the crop yields.

WHEAT VARIETIES.

A test of six varieties of spring wheat grown in duplicate on twentieth-acre plats was conducted in field C–III. A similar test was conducted with four of these varieties in the same field in 1914. The average yields obtained in both years are given in Table IX.

TABLE IX.— *Yields of spring wheat in the variety test on the Huntley Experiment Farm in 1914 and 1915.*

Variety.	Yield per acre (bushels).			Variety.	Yield per acre (bushels).		
	1914	1915	Average.		1914	1915	Average.
Marquis	30.8	63.3	47.0	Dicklow	29.4	41.9	35.6
Pringle Champlain	35.4	55.0	45.2	Defiance	.....	56.0	.....
Stanley	27.1	47.9	37.5	Kubanka	.....	49.1	.....

In 1915 all the varieties were somewhat lodged, although the Marquis, Stanley, and Dicklow were less affected by lodging than any of the other varieties. In 1915 the Dicklow and Stanley varieties, both soft wheat, were the only ones that were affected by rust. In 1914 all of the four varieties grown were affected about equally by rust. The Pringle Champlain also was grown as a nurse crop in all of the method-of-planting tests with alfalfa and grasses and in the rotation experiments, and it appears to be well suited to conditions on the project. The Marquis gave the highest yield in 1915. Because of its stiff straw, it is likely to be less affected by lodging than some of the other varieties.

POTATO VARIETIES.

A test of potatoes in which 16 varieties were grown in triplicate 8-rod rows was conducted in field C–V. The varieties grown and the yields obtained are shown in Table X, in which the yields reported are the average of three rows in each instance.

TABLE X.— *Yields of potatoes in the variety test on the Huntley Experiment Farm in 1915.*

Variety.	Yield per acre (bushels).			Variety.	Yield per acre (bushels).		
	Marketable tubers.	Culls.	Total.		Marketable tubers.	Culls.	Total.
Burbank	262.1	52.6	314.7	Howard Elliott	147.8	23.8	171.6
Vermont Gold Coin	205.9	27.5	233.4	Early Eureka	145.4	25.1	170.5
White Elephant	201.0	26.9	227.9	Rural New Yorker	149.1	20.7	169.8
Mills Prize	207.7	14.7	222.4	Early Petoskey	145.4	20.8	166.2
Early Acme	191.3	18.9	210.2	Green Mountain	133.2	18.9	152.1
Irish Cobbler	156.4	24.4	180.8	Stray Beauty	127.6	21.4	149.1
Early Ohio	164.4	14.6	179.0	Early Six Weeks	129.0	17.0	146.0
Blue Victor	161.3	11.9	173.2	Triumph	101.4	27.5	128.9

Several of the late varieties, including the Green Mountain, Rural New Yorker, Mills Prize, Howard Elliott, White Elephant, Vermont Gold Coin, and Burbank, were not fully matured at harvest time because of the short season. Of the early varieties the Early Acme, Blue Victor, and Early Ohio gave the best results. The Early Acme appears to be a specially promising variety. The Irish Cobbler is a good midseason variety and was fully matured at harvest time.

CORN VARIETIES.

A test in which eight varieties of dent corn and four varieties of flint corn were grown was conducted in field A. Seven of the varieties were grown in a similar test in 1914. This test was conducted in cooperation with the Office of Corn Investigations of the Bureau of Plant Industry.

The season of 1915 was rather unfavorable for corn. As a result of the cool weather during the early part of the summer, the crop was backward and only a few of the varieties were matured at the time of the first severe frost, which occurred on October 3. The varieties most fully matured were the Gehu Flint, Dakota White Flint, Minnesota No. 23, Disco Flint, Rustler White Dent, Northwestern Dent, and Eighty-Five-Day Disco. In 1914 all the varieties were fully matured before frost. In both years samples were taken for moisture determinations, and the yields recorded are based on the dry weights. The yields obtained in 1914 and 1915 are given in Table XI. The yield in each case is the average of three plats, except in the case of Northwestern Dent, of which there were 31 plats in 1914 and 33 plats in 1915.

TABLE XI.— *Yields of corn in the variety test on the Huntley Experiment Farm in 1914 and 1915.*[1]

Variety.	Date of maturity.		Weight per bushel of corn on cob (pounds).			Yield per acre.								
						Bushels (at 72 pounds per bushel).			Stover (pounds).			Total grain and stover (pounds).		
	1914	1915	1914	1915	Average.	1914	1915	Average.	1914	1915	Average.	1914	1915	Average.
Selection No. 133	Sept. 28	Oct. 15	71.6	78.9	75.2	50.2	54.2	52.2	4,928	4,791	4,859	8,209	8,693	8,451
Martens White Dent	Sept. 25	Oct. 10	70.6	78.8	74.7	57.1	45.8	51.4	4,591	4,166	4,278	8,708	7,464	8,086
Northwestern Dent	Sept. 15	Oct. 5	69.1	73.1	71.1	48.1	40.5	44.3	3,720	2,376	3,048	7,190	5,292	6,241
Minnesota No. 13	Sept. 21	Oct. 15	69.6	70.2	69.9	39.2	37.6	38.4	2,579	2,908	2,743	5,582	5,615	5,598
Gehu Flint	Sept. 5	Sept. 25	69.0	68.7	68.8	35.9	39.8	37.8	2,471	2,483	2,477	5,056	5,349	5,202
Minnesota No. 23	Sept. 10	Sept. 30	67.0	70.5	68.7	34.6	35.3	34.9	2,387	2,525	2,456	4,778	5,067	4,922
Cassia County Flint	Sept. 21	.....	68.6	.....	.....	55.8	.....	.....	4,161	.....	.....	8,186	.....	.....
Triumph Flint	..do	.....	74.3	.....	.....	55.4	.....	.....	6,370	.....	.....	10,393	.....	.....
Brown County Yellow Dent.	Sept. 25	.....	66.6	.....	.....	44.5	.....	.....	3,713	.....	.....	6,919	.....	.....
Longfellow Flint	Sept. 28	.....	69.6	.....	.....	42.9	.....	.....	2,629	.....	.....	10,717	.....	.....
Fort Peck Squaw	Sept. 5	.....	69.0	.....	.....	27.2	.....	.....	2,389	.....	.....	4,346	.....	.....
White Australian Flint	.....	Oct. 15	.....	89.4	.....	.....	50.9	.....	.....	4,816	.....	.....	8,481	.....
Dakota White Flint	.....	Sept. 30	.....	68.3	.....	.....	45.2	.....	.....	2,200	.....	.....	5,454	.....
Eighty-Five-Day Disco	.....	Oct. 1	.....	73.2	.....	.....	39.1	.....	.....	2,741	.....	.....	5,556	.....
Disco Pride	.....	Oct. 10	.....	69.5	.....	.....	36.9	.....	.....	2,391	.....	.....	5,048	.....
Disco Flint	.....	Sept. 30	.....	74.5	.....	.....	35.7	.....	.....	4,883	.....	.....	7,453	.....
Rustler White Dent	.....	Oct. 10	.....	69.7	.....	.....	33.7	.....	.....	2,483	.....	.....	4,904	.....

[1] In 1915 the length of time that would have been required for the varieties to mature that were not matured at the time of the first severe frost, October 3, was estimated.

The variety known as U. S. Selection No. 133 gave the highest average grain yield for the two years, although it was the latest maturing variety. This variety also produced a high average total yield of grain and stover. Martens White Dent ranked next in yield of grain and in total yield. Of the dent varieties, these two are promising as crops to grow for silage. Of the flint varieties, the Triumph, Longfellow, and White Australian produced the highest total yields, although they were all late in maturing.

ORCHARD TREES AND SMALL FRUITS.

A test of about 100 varieties of apples, cherries, and plums has been under way since 1911. A large number of these varieties suffered badly from winter injury during the winters of 1911–12, 1912–13, and 1913–14. During the winter of 1914–15, practically none of the trees was winterkilled. In the spring of 1915 about 85 trees of the following varieties were planted to take the place of trees that were lost by winterkilling during 1913–14: Wealthy, Patten, Alexander, Livland Raspberry, Fameuse, Yellow Transparent, and University. These varieties were chosen as being the most hardy of the 50 varieties tried in 1911 and 1912. Practically all the 11 varieties of crab apples tried have proved hardy. The following varieties of plums planted in 1911 bore small quantities of fruit in 1915: Compass Cherry, Stoddard, Weaver, and Wyant. These varieties, together with the Hammer, Terry, De Soto, Wolf, German Prune, Surprise, Aitkin, and Forest Garden, have proved to be the most hardy of the 27 varieties originally planted. In the spring of 1915 five plants each of 20 varieties of grapes were planted in field A–II–13.

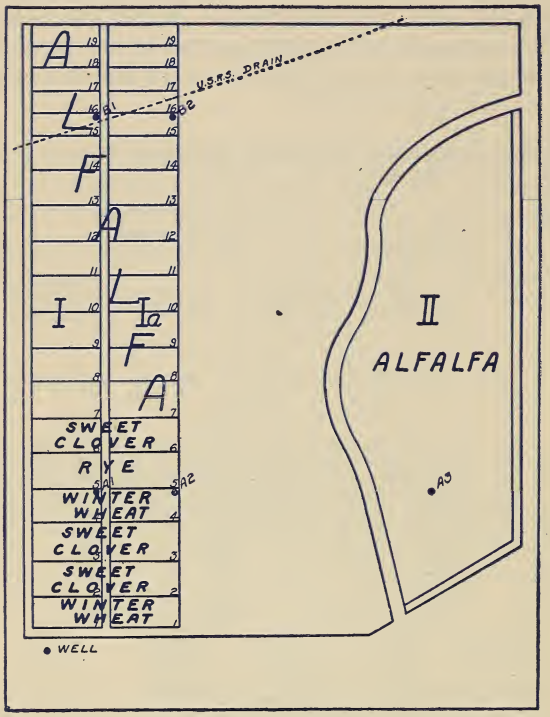

FIG. 6.—Diagram showing the arrangement of the fields, the location of the test wells, and the crops grown on the Worden tract in 1915.

All of the small fruits planted in 1911 have given good results. The test included raspberries, blackberries, gooseberries, currants, June berries, and strawberries. The conditions on the project appear to be favorable for the production of these fruits.

RECLAMATION OF THE WORDEN TRACT.

Since 1910, experiments have been conducted on a tract of heavy, salty soil near the town site of Worden, to determine means of reclaiming this land and bringing it into production. Different

treatments applied to the land during the first two years after the experiments were begun were apparently effective in reducing the salt content of the soil, and fairly good crops were produced in 1913. Since that time there has been a rapid rise of the ground water under this area. This ground-water rise was greater on the western part of this tract, and as a result most of the crops on that part of the tract were practically failures. The eastern part of the tract was affected less by the rise of the ground water on account of an open drain that extends through the tract between the two fields. This part of the field was planted to alfalfa in 1914 and this crop

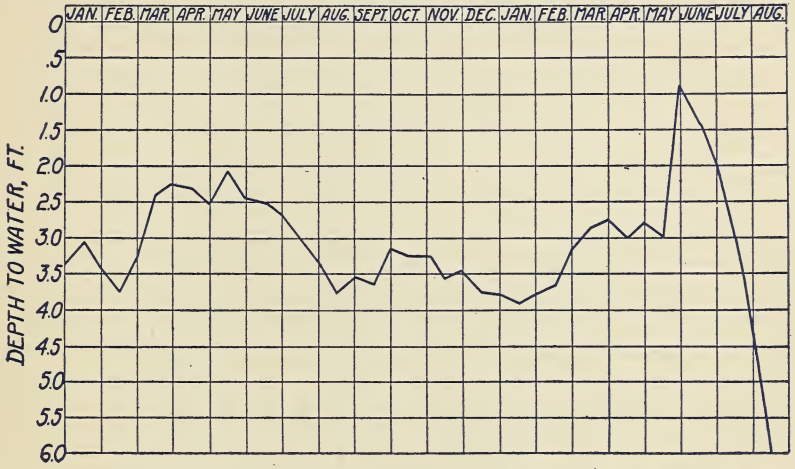

FIG. 7.—Diagram showing the average depth to ground water in five wells on the Worden tract from January 1, 1914, to August 15, 1915. The sharp fall of the ground water after June 1 resulted from the installation of the drain shown in figure 6.

gave good results in 1915. A map of the Worden tract is shown as figure 6.

Determinations of ground-water levels, made biweekly in five wells on this tract in 1914 and 1915, showed that in 1914 the average depth to ground water was 3.09 feet. In 1915, from January 1 to July 15, the average was 2.59 feet, and at one time, on June 3, it was only 0.77 foot. The results of the ground-water measurements are shown in figure 7. A drain that was installed through this field in July, 1915, was effective in lowering the ground water to a depth below 6 feet. It is expected that this drainage will permit the reclamation of the tract to be carried forward.

The salt content of this soil, as shown by determinations made each year since 1910, was increased during 1914 and 1915 as a result of the rise of the ground water. This increase was especially marked in the surface 2 feet of soil. In 1915 the only crop that gave good

results on the west side of the tract was sweet clover. One plat of this crop produced hay at the rate of 3.09 tons per acre and another at the rate of 2.01 tons per acre. After the hay was removed the sweet clover made a good second growth, which was plowed under. On one plat that was left for seed, a yield at the rate of 100 pounds per acre was secured, although much of the seed on this plat was lost by shattering as a result of a heavy wind after harvest.

A 7-acre field on the east side of the tract, which was less seriously affected by the rise of ground water, was planted in 1914 to alfalfa, of which an excellent stand was secured. A test of seed production was conducted with this alfalfa in 1915. On one part of the field the first crop was left for seed. The yield of seed on this field was 2.3 bushels per acre. On the other part of the field the first crop was cut for hay and the second crop was left to make seed. The yield of hay of the first crop was 1.75 tons per acre. Much of the seed produced by the second crop was not fully matured at the date of the first frost, and a large part of it was lost by shattering as a result of a heavy wind after the seed was cut. For these reasons the crop was not thrashed.

The indications are that where adequate drainage is provided, the methods which have been found effective in improving the surface soil on this 40-acre tract can be applied with slight modifications to practically all those parts of the project which are characterized by this heavy alkaline soil. These methods are discussed in detail in Department of Agriculture Bulletin No. 135, entitled "Experiments in the Production of Crops on Alkali Land on the Huntley Reclamation Project, Montana," issued in September, 1914.

Approved:
WM. A. TAYLOR,
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MAY 1, 1916.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1916